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Sale Prices as a Basis for Farm Land Appraisal

By G. C. Haas
Division of Agricultural Economics

UNIVERSITY FARM, ST. PAUL

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SALE PRICES AS A BASIS FOR FARM LAND APPRAISAL

By G. C. Haas*.

The analysis of land valuation ordinarily resolves itself into four phases, as follows: (1) the general structure of land values; (2) geographical variations in land prices, as between states and sections of the country; (3) movements in land prices; (4) local variations in land prices. This study is confined to the fourth phase, local variations. The method of analysis has been to correlate the sale prices of 160 farms in Blue Earth County, Minnesota, sold in 1916, 1917, 1918, and 1919, with the factors influencing land prices, namely, value of buildings per acre, type of land, crop yields, distance from market, size of adjacent city or village, and type of road upon which located, and to derive from this correlation an equation from which the probable sale price of any other farm land in the same general territory may be determined.

This method assumes that land sale prices are the best basis for an appraisal policy. Appraising land means forecasting or predicting what it would sell for on the basis of the present market. The figure sought is probable market price, and not what any person, no matter how good his judgment, thinks the land should be worth. Market prices are the results of the judgments of the land market composed of buyers and sellers of the general order of intelligence.

Many persons consciously or unconsciously assume that the only scientific basis for land appraisal is the productivity of the land. While it is true that land derives its value solely from its products, and, therefore, its value must be proportional to the value of its product, nevertheless its productivity can not be made the basis for its appraisal, for several reasons, as follows: (1) The product of land is perpetual and no one can forecast the amount or value of it or determine the present worth of future products. To determine the present worth, one must know the rate at which land income is capitalized now and in the future. (2) The product required is net product, and to obtain net product, one must have costs of production. Several of the important costs of production, such as value of family labor and wages of management and responsibility-taking, can not even be estimated. There is a very wide range in net product on different farms if the profits of farmers are included in net product. Also many costs of production, such as taxes, fertilizers, wages, are likely to be different in the future. (3) It is impossible to determine the income from farm

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land from its use as residence and all the elements of psychic income associated with this. For all these reasons, no reputable scientific method of appraisal can be based on productivity.[1]

The land market.—Since the sale prices we are analyzing are actual market prices, we must consider the nature of the market in which these prices are made. The concept of a market needed for this purpose must be carefully drawn. Following are several statements concerning a market which are significant in this connection: "A market * * * is the totality constituted by a group of competing sellers over against a group of competing buyers concerned in exchanging the same commodity."[2] "Economists understand by the term market, not any particular market place in which things are bought and sold, but the whole of any region in which buyers and sellers are in such free intercourse with one another that the prices of the same goods tend to equality easily and quickly."[3] "Originally a market was a public place in a town where provisions and other objects were exposed for sale, but the word has been generalized so as to mean any body of persons who are in intimate business relations and carry on extensive transactions in any commodity. * * *. The traders may be spread over a whole town, or region of country, and yet make a market, if they are, by means of fairs, meetings, published lists, the post-office or otherwise, in close communication with each other."[4]

The essential idea of a market is organization. The organization is usually informal and unconscious, but it may become conscious and formal. This organization furnishes contacts or means of communication between the buyers and sellers in the market. A market is "perfect" or "ideal" to the extent that the organization is complete and all persons in it are constantly and instantly in full knowledge of one another's offers and acceptances. In a perfect market, either the commodity sold is uniform or else there is complete and accurate knowledge of all differences in it. Obviously, in such a market there can be but one price for the same thing at the same time.

The land market is certainly not a perfect market. Wherein does it fail? First of all, the commodity bought and sold is not uniform. This would make no difference, however, if the elements of variation in it were perfectly comprehended. But this we know to be far from the case. Determining the extent to which the elements of difference in land are actually reflected in differences in prices, in spite of the

[1] See Bulletin of the International Institute of Agriculture, Nos. 10-12, October-December, 1912, "The Value of Landed Property" by Frederick Aereboe, Chief of the Division of Rural Economy at the Royal School of Agriculture, Berlin. "The so-called valuation according to revenue is impracticable, unscientific and indefensible." p. 2343.

[2] Taylor, F. M., "Principles of Economics," p. 210. 5th ed.

[3] Cournot. "Recherches sur les Principes Mathématiques de la Théorie des Richesses."

[4] Jevons. "Theory of Political Economy." Ch. III.

imperfections of the land market, is of course a major problem of this investigation. The local variations or elements of difference in land will be analyzed a little later. Second, the land market is not well organized. There is no extensive or efficient means of disseminating information among buyers and sellers. There may be comparatively few buyers and sellers competing at any one sale. All sellers are not able to put their offerings before all the purchasers and also all buyers do not have a chance to provide all sellers with an opportunity to sell to them.

Because they lack bargaining power, or are at an economic disadvantage, buyers and sellers are not always able to act rationally on information received. Also, many buyers and sellers are frequently influenced by non-economic motives, such as home ties, caprice, passion, and prejudice. Professional land salesmen have more than average knowledge concerning the land market and usually have the advantage when it comes to bargaining, and, of course, succeed in making many sales of the same grade of land at different prices.

In spite of all these circumstances, however, the general tendency on the part of both buyers and sellers is to investigate the market rather thoroly, the buyers seeking for the best bargain, and the sellers seeking for the purchaser offering the high price. The mere fact that those who do not deal cautiously and with discretion are known in the land market as "suckers," and the sales resulting as "sucker sales," indicates that such sales are not common. The land market surely tends to operate in such a way as to cause the same grade of land to sell in the same market at the same time at like prices, altho the adjustment is never perfect and there is always some variation in the market price of the same grade of land. Such variation as there may be is, of course, of much importance in the operation of a system which aims to predict the market price of land on the basis of sale prices. The results of this investigation will throw some light on the importance of this variation.

The basis of land values.—To explain the significance of local differences in land, we must understand the basis of land values. Land has value because it produces an income in the form of materials or services that satisfy human wants. The income may be material or psychic or both. The material income appears in the products of the soil, the psychic income in wants directly satisfied by it, such as the want for a site for a home in a good neighborhood on a good road near a city or village.

Land yields these incomes in perpetuity. The value of a piece of land is the present worth of its incomes in perpetuity. If it can be assumed that the future incomes will all be the same as present incomes, then the value of land is expressed by the formula:

$$V = \frac{a}{r}$$

when V = the value of the land, a = its annual net income, and r = the prevailing rate of interest.[5] This, of course, is simply the formula for deriving the value of a constant-income bearer by capitalizing the income.

It is not reasonable to assume, however, that the future incomes from land will be the same as the present incomes. It is usually assumed that because of increase in population, future incomes will be greater than present incomes. The formula for capitalizing an income increasing at a constant arithmetical rate is as follows:

$$V = \frac{a}{r} + \frac{i}{r^2}$$

where i = the increase in income. In applying this to land, however, one must realize that we do not know what the increases in incomes will be. Hence i must represent "anticipated increase in annual income." Let us assume, for example, that for a given farm, the value of a per acre is $5, that r is 5 per cent, and that a is expected to increase at the rate of 10 cents per year. Substituting in the formula:

$$V = \frac{5.00}{.05} + \frac{.10}{(.05)^2} = 100 + 40 = 140$$

The value of this land per acre is $140, of which $40 is based on anticipated increase in income.

The prevailing opinion as to future incomes, therefore, plays a large role in determining land values. Land values never represent present earning power capitalized. Different farmers and real estate men have greatly varying ideas as to the future of land incomes. However, to the extent that the land market is a perfect market, one level of opinion as to future income becomes the market level, and those who have a less optimistic idea of the future either do not buy or sell too cheaply, or perhaps sell for more than they think their land is worth. In any one county, such as Blue Earth County, in normal times this market level of opinion is likely to be fairly well established. The future element in land values, therefore, is not so serious a complication in a study of local variations as one would at first think.

[5] Fisher. "The Nature of Capital and Income." p. 202. Taylor. "Agricultural Economics." p. 206.

It can be said safely that in no case does the buyer or seller of a farm have the exact income data before him. He may know with a fair degree of accuracy what the physical income of the land is for one year, or past years, but he does not know it for the future. He will have only a fairly definite idea of what the psychic income is worth to him. But buyers and sellers do not attack the problem in this way. Instead, they proceed by comparison and analogy. They compare the farm in question with other farms with the incomes or values of which they are familiar. All factors in the farm in question which may influence income are compared with known cases where they can approximate their effect. Any farm, therefore, becomes to them a combination of factors which affect income or value.

The method of attack in this investigation is essentially that of the prospective buyer.

To analyze market prices successfully, one must follow up the channels of thought of those who make the market prices. A good appraisal system for land should analyze as the market thinks. Practical men will go further and say that the only method by which land can be appraised is to call in several men of good sense and judgment and let them analyze in the manner of prospective buyers; in other words, make "an experienced guess." Such men are given to saying that "every farm is a thing by itself," and that therefore it is impossible to combine a large number of farms in one analysis and obtain any results worth while. Modern statistical science, however, does offer a workable method of doing this. If accurate measures of the factors influencing land values can be obtained, it is entirely possible by tabulation and partial and multiple correlation methods to determine the weights or significance of the various factors. These are the methods used in this investigation. They are described in detail later.

In every territory the factors which influence value are somewhat different. In the section studied, the following factors were considered: (1) The 1919 depreciated cost of buildings per acre; (2) land classification, or the amounts of the different types of land; (3) productivity of the soil, represented by relative crop yields; (4) distance to market; (5) type of road; (6) size of market town. These factors will be explained later in detail.

THE AREA

Blue Earth County was selected as an area in which to work out the problem because it is more than usually uniform as to soil, topography, and systems of farming, and because at the same time it offers the necessary variations in village and city centers, types of roads, and the like. It was thought best not to complicate the problem too much

at the start by choosing too heterogeneous an area; if the method attained promising results in a simple area, after being further developed it could be applied to a more difficult one. Furthermore, Blue Earth County is one of the few counties in Minnesota for which there is a soil survey.

Blue Earth County is in south central Minnesota, on the south side of the Minnesota river, not far from the city of Mankato, where the river bends northward. Figure 1 shows the Blue Earth river with its tributaries, the Le Sueur, the Maple, the Big Cobb and Little Cobb rivers, converging within a radius of ten miles from the confluence of the Blue Earth with the Minnesota river at Mankato. The area is a flat gently rolling expanse with an imperceptible slope from east, south, and west toward Mankato. "The country in the neighborhood of streams, where erosion has been most active, is always

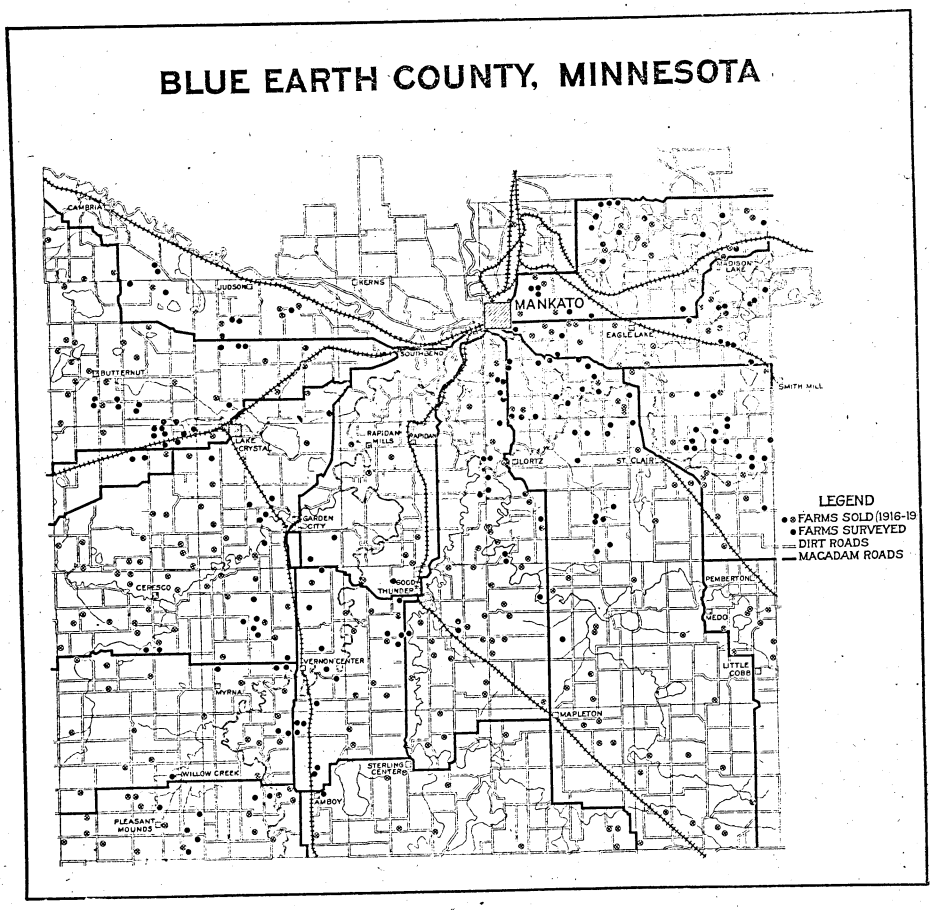

Fig. 1. Location of Farms Covered in the Survey

more or less broken and rolling. Some of this is too rough for profitable cultivation. The land surface is interrupted here and there by glacial lakes varying in size from those too small to be represented on a map to bodies of two square miles in extent. The principal lakes in order of size are Jackson, Madison, Eagle, and Loon. About five-sixths of the area was originally prairie. The streams and lakes were fringed with a narrow strip of timber."[6]

The land area of the county is 749 square miles, or 479,104 acres. Table I gives the census information as to the agriculture of the county. The system of farming prevailing is a modification of the corn, cattle, and hog farming of the Corn Belt. More wheat is grown than in the Corn Belt, and it is mostly spring wheat in place of winter wheat. Also more hay and forage are grown, and the cattle industry includes nearly as much dairying as beef in many sections of the country. Hog-raising is important, but of course not so important as in the Corn Belt. Exclusive stock and dairy farms are few in number, but the increase in dairying has been rapid in recent years. Sheep-raising is practiced

[6] Soil Survey of Blue Earth County, Minnesota, pp. 813-5.

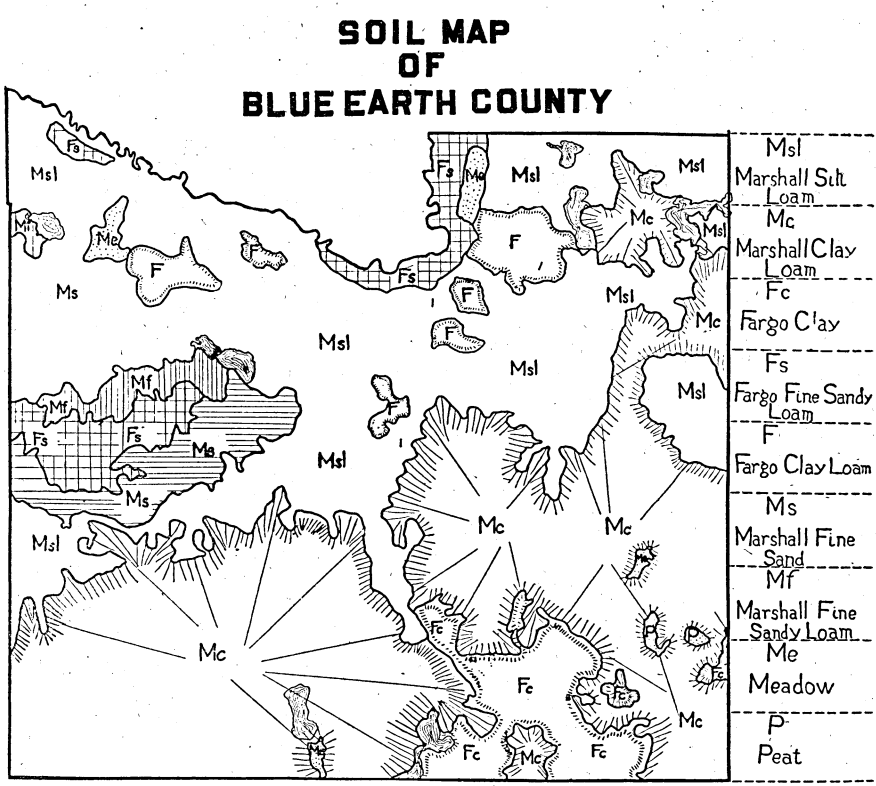

Fig. 2. Distribution of Soil Types

especially on farms which are adapted to grasses or are infested with quack grass. The principal crops raised in order of acreage are hay, corn, wheat, oats, barley, and rye.

Soils.—All but 8.4 per cent of the soils of Blue Earth County belong to two soil series, namely, the Marshall and Fargo series; and 79.2 per cent belong to the Marshall series alone. The Marshall soils, predominating in the uplands, are the typical dark-colored glacial-till soils with high organic content occurring throughout the Corn Belt. The Fargo soils, predominating in the flat areas and depressions, are the black sticky soils that occur in the Red River Valley.

By soil types, 85.4 per cent of the soil is classed as loam, 5.8 per cent as clay, 4.0 per cent as meadow, 3.3 per cent as fine sand, 1.6 per cent as peat, and 0.6 per cent as sand. Of the loams, 43.7 per cent are clay loams, 29.7 per cent are silt loams, and 7.5 per cent are fine sandy loams. All these loams are first-class soils, except perhaps for the Fargo fine sandy loam (1.6 per cent) which is only fair. Altogether, aside from the meadow and peat areas, only about 7 per cent of the soil is not of good quality. Much of it is, however, quite heavy and can not be worked when it is wet, but it holds moisture well and produces large yields. Some of it, to be sure, has to be tiled to make it good farming land.

Figure 2 shows the general distribution of the principal soil types. Many small areas of peat and meadow are, of course, not shown; likewise many small included areas of soils of other types. The Marshall loam is included with the Marshall silt loam; also the Mankato sand with the Fargo fine sandy loam. Also the narrow fringes of Wabash soils along the rivers are included with the adjoining soils.

The 160 farms used in the survey are located on soil types as follows:

Marshall silt loam	42
Marshall clay loam	41
Fargo clay loam	13
Marshall clay loam and Fargo clay loam	23
Marshall silt loam and Marshall clay loam	19
Marshall loam	3
Wabash fine sandy loam and Marshall silt loam	6
Marshall fine sand and Marshall fine sandy loam	5
Other combinations	8

Thus 61 of the 160 farms have two or more soil types indicated on the soil map. This does not include areas of peat and meadow found on a large number of the farms, and areas of other soils too small to be shown on the map.

TABLE I

BLUE EARTH COUNTY AGRICULTURAL STATISTICS, 1920 CENSUS

Number of farms	2,954
Per cent of land area in farms	90.3
Per cent of farm land improved	80.7
Average acreage per farm	149.1
Average improved acreage per farm	120.3
Per cent of farms operated by owners	68.6
Per cent of farms operated by tenants	30.8
Livestock	Total No.
Horses	17,476
Beef cattle	19,365
Dairy cattle	32,470
Sheep	7,319
Swine	61,318
Crop Acreage	Acres
Corn	70,325
Oats	42,265
Wheat	66,227
Barley	3,820
Rye	3,462
Hay and Forage	76,625

Markets.—Mankato, the county seat, with a population of 12,469 in 1919, is an important railroad and manufacturing center. The only other important towns are Lake Crystal, Vernon Center, Garden City, Amboy, Mapleton, Good Thunder, Madison Lake, and Eagle Lake, with populations ranging from 300 to 1200. The transportation and market facilities are good. Only a small proportion of the county is situated more than ten miles from a shipping point. The county is served by four railway lines; the Chicago Great Western; the Chicago, St. Paul, Minneapolis & Omaha; the Chicago, Milwaukee & St. Paul; and the Chicago & Northwestern. There are grain elevators and stock-yards at convenient points along these lines everywhere throughout the county; also flour mills at various towns with outputs of from 50 to 1000 barrels a day. Keen railroad competition makes freight rates moderate and provides rapid service to Omaha, Minneapolis, St. Paul, Chicago, and other large cities. Thus there are ready outlets for any kind of produce.

Population.—The population of the county in 1919 was 31,477, made up of Americans, Germans, Swedes, Norwegians, and Welsh, named in order of relative numbers. The Welsh are in the Lake Crystal neighborhood, and the Germans in the section southwest of Vernon Center. The population is cosmopolitan everywhere, however; it is not uncommon to hear several languages spoken in one small community. As a rule, the farmers are hard-working and prosperous. Many of the farmers have acquired considerable wealth and now live in towns and rent their farms. In general the farm houses are neat and substantial.

METHOD OF SECURING DATA

The farms which were considered were those which were actually sold during the four-year period, 1916 to 1919 inclusive. The sale prices which were used are the considerations which were given when the transfer of deed was recorded, as collected by the Minnesota State Tax Commission.[7] In compiling these records, the Tax Commission discards all sales considerations which do not seem to be bona fide, such as those arising from trades, from transfers to relatives, and the like. The Tax Commission finally submits the reports on each farm to real estate men and bankers in each community, and these men weed out any which appear fictitious to them. As a result, the sale prices used in the study represent bona fide sales as nearly as it is possible to obtain them.[8]

The following information for each farm was transferred to cards before the field work was started. Also a map was prepared showing the location of the farms to be included. Each farm was marked with a number.

Date of Sale, March 1, 1919. Number———
Seller, A. Churchyard. Buyer, W. J. Cornhill
Legal description, S½ of N½ of SW¼ and W½ of S½ of SW¼
Section 32, township 108, range 20, 80 acres.
Consideration, $12,400
Assessed value of land, $8,160
Assessed value of buildings, $1,000
Assessed value of farm, $9,160

Appendix A presents a copy of the schedule used in the field together with the instructions for its use. The purchase price of the farm appears only on the card.

Very little difficulty was experienced in taking the records. The dimensions of buildings were actually measured in most cases. The farmers did not always know the age of the buildings. In such cases, estimates were made and checked afterward whenever possible. Errors of estimate on old buildings are of little significance. Likewise many farmers, especially if they had purchased their places within a year or two, could not give yields of crop for a few years. Yields for three years, however, were obtained in most cases.

Altho the Tax Commission records show 379 bona fide sales in Blue Earth County from 1916 to 1919, only 160 farms were covered

[7] Access to the sales data files of the Minnesota State Tax Commission was given us through the courtesy of the Tax Commission.

[8] We also asked each farmer the purchase price of his farm as an additional check. In only two instances did the purchase price given by the farmer disagree with the sale price on record. The difference in these two cases was only about $200 on $20,000 sales.

in the survey. Figures 1 and 2 show that these 160 farms are well distributed both as to location and soil types.

Method of analysis.—Altho it is not the province of this treatise to explain the theory of multiple or partial correlation, some discussion of its use is needed at this point. If in two series of variables—for example, in this case, cost of buildings per acre and value per acre—a high value of one tends to be associated with a high value of another, the variables are said to be correlated and the correlation is positive; while if a high value of one is associated with a low value of another, as in the case of distance to market and value per acre, the correlation is negative. The best numerical measure of the amount of correlation is called Pearson's coefficient of correlation. The algebraic formula for this is:

$$r_{12} = \frac{S X_1 \cdot X_2 - N \cdot M_1 \cdot M_2}{\sqrt{(S X^2_1 - N \cdot M^2_1)\ (S \cdot X^2_2 - N \cdot M^2_2)}}$$

In a problem in which more than two factors are concerned, the simple or gross correlation may be an expression only of an apparent relationship. This apparent correlation may be due to the fact that each of the two variables or factors is correlated with another or several variables. For example, assume in this case that distance to market and value per acre show a negative correlation, but as distance from town increases the percentage of land of desirable grade decreases, or in other words, that there is also a negative correlation between distance to market and the percentage of land of desirable grade. The gross or apparent negative correlation of distance to market and value per acre is partly due to the fact that as the distance from market increases, the percentage of land of desirable grade becomes smaller, this operating to make the farms more distant from market sell cheaper, not due to distance alone as the simple coefficients might lead one to believe.

In a problem of the type that land-appraising presents, where the relationship between several variables or factors must be considered simultaneously, a coefficient of net or partial correlation is calculated. Thus if we are considering four variables, 1, 2, 3, and 4, the partial coefficient of correlation $r_{12.34}$ means the net relationship between variables 1 and 2 when the effect of factors 3 and 4 are held constant.

When three variables are considered, the partial correlation $r_{12.3}$ may be calculated from the formula:[9]

$$r_{1.23} = \frac{r_{12} - r_{13} \cdot r_{23}}{\sqrt{1 - r^2_{13}} \cdot \sqrt{1 - r^2_{23}}}$$

By further expansion, the formula for five variables as used in this problem is:

[9] Yule, G. U. "An Introduction to the Theory of Statistics." 5th ed. 1919.

$$r_{15.234} = \frac{r_{15.34} - r_{12.34} \cdot r_{25.34}}{\sqrt{1 - r^2_{12.34}} \cdot \sqrt{1 - r^2_{25.34}}}$$

From the coefficients of correlation, we can determine the coefficients of relationship expressed in absolute units, known as coefficients of regression: for example, $b_{15.234}$ (σ representing standard deviation).

$$b_{15.234} = r_{15.234} \frac{\sigma_{1.5234}}{\sigma_{5.1234}}$$

The forecasting formula is readily determined when once the regression coefficients are known. Following is the generalized formula:

$$X_1 = a + b_{12.345} \cdot X_2 + b_{13.245} \cdot X_3 + b_{14.235} \cdot X_4 + b_{15.234} \cdot X_5$$

(X_1 represents value per acre in this case, and X_2, X_3, X_4, X_5, the other factors considered.)

The probable error involved in predicting X_1 from the other factors is expressed in the formula:

$$\sigma_{1.2345} = \sigma_1 \sqrt{(1 - r^2_{15})} \sqrt{(1 - r^2_{14.5})} \sqrt{(1 - r^2_{13.45})} \sqrt{(1 - r^2_{12.345})}$$

Probable error $= \sigma_{1.2345} \times 0.674489$

These equations and explanations are presented so that the reader will be familiar with the notations when they are used later.[10]

Value per acre.—The problem under value per acre is to reduce the sale prices of sales made during a four-year period, during which prices were rising rapidly, to a comparable basis. First we must make sure that the relative distribution of grades of land sold in the different years was the same. The statistical measure best adapted to show this is the "coefficient of variation," solved by the formula:[11]

$$V = 100. \frac{\sigma}{M}$$

The coefficient of variation in the fourth column of Table II shows that the distribution of grades of land was very similar during the four years. The average sale prices per acre for the four years, given in the second column, are, therefore, closely comparable. The third column reduces these prices to indices, base year 1919. The sale prices of the farms bought in 1916, 1917, and 1918 were raised to 1919 level by dividing them by the index number for that year as given in this table. Thus a farm sold for $150 per acre in 1917 would have sold for $189.49 per acre in 1919 ($150÷.79157). This method introduces

[10] Persons interested in the technique of the method are referred to G. U. Yule's "On the Theory of Correlation for Any Number of Variables Treated by a New System of Notation." Proceedings Royal Society, Series A., Vol. LXXIX 1907, p. 182; also to Yule's "An Introduction to the Theory of Statistics."

[11] Yule, G. U. "An Introduction to the Theory of Statistics." 5th ed. 1919. Pearson, Karl, "Chances of Death."

some error into the calculations because it divides each sale price by the average for the whole year. It is likely that prices in January and December will, during a period of rising prices, be respectively below and above the average. This error will be greatest in 1919. The only method of correcting for this is to get indices by months. This can be done in surveys made in the future.

TABLE II

YEARLY AVERAGE SALE PRICE PER ACRE, INDICES OF SAME, AND COEFFICIENT OF VARIATION FOR EACH YEAR

Year	Average sale price	Indices	Coefficients of variation
1919	$157.23	100.000	24.135
1918	134.96	85.837	26.250
1917	124.46	79.157	25.618
1916	114.52	72.836	25.557

Differential for state macadam and dirt roads.—The differential for dirt and macadam roads was determined by cross-tabulation. In the final results, lands on macadam roads were reduced to a dirt road basis. Following is the solution of the problem: First of all, a simple tabulation gave the following results:

Average value per acre of 10,393 acres on dirt roads =$147
Average value per acre of 4,873 acres on state roads = 171

Differential ..... $ 24

Tables III and IV test the validity of this differential by cross-tabulation. The assumption basic to this method is that if $24 is a true constant difference between state and dirt roads, it should appear also in any cross-tabulation of data on the basis of other factors, provided the acreage included in each class interval is large enough to allow the effects or the influence of the other factors to average out or compensate. In Table III, a constant difference of about $20 appears in the classes where the distribution is large: for example, in the class interval "Cost of buildings, $0-$12"—dirt roads, $131, and state roads, $153; and also in the class $12-$24—dirt roads, $152, and state roads, $173. In the other classes in this table, the number of acres is too small to furnish evidence as to the genuineness of the differential. Similarly in Table IV, the cross-tabulation on the distance-to-market basis, the differential of about $20 again occurs in the classes having the large distributions; for example, in class interval 0-2.5 miles—dirt roads, $160, and state roads, $180; and class 2.5-4.5 miles—dirt roads, $155, and state roads, $173.

TABLE III

CROSS TABULATION ON BASIS OF STATE AND DIRT ROADS AND COST OF BUILDINGS PER ACRE

Dirt Roads			State Roads		
Cost of buildings per acre	Value per acre	Acres	Cost of buildings per acre	Value per acre	Acres
$ 0–$12	$131	4,949	$ 0–$12	$153	1,492
12– 24	152	4,037	12– 24	173	2,164
24– 36	182	1,058	24– 36	189	733
36– 48	...	...	36– 48	164	176
48– 60	213	349	48– 60	194	277
60– 72	...	...	60– 72	...	...
72– 84	...	...	72– 84	349	30

TABLE IV

CROSS TABULATION ON BASIS OF STATE AND DIRT ROADS AND DISTANCE TO MARKET (MILES)

Dirt Roads			State Roads		
Distance to market	Value per acre	Acres	Distance to market	Value per acre	Acres
0– 2.5	$160	2,546	0– 2.5	$180	1,498
2.5– 4.5	155	4,104	2.5– 4.5	173	2,309
4.5– 6.5	133	2,161	4.5– 6.5	203	210
6.5– 8.5	131	1,352	6.5– 8.5	138	712
8.5–10.5	127	155	8.5–10.5	189	40
10.5–12.5	78	75	10.5–12.5	169	102

From the results in Tables III and IV, a weighted average differential for state roads was determined. Only the differentials appearing in the largest two classes in these tables were used. These were weighted according to number of acres in the class. For Table III, this gave a weighted difference of $24.44 per acre; for Table IV, $18.87 per acre. These two averaged according to acreage weights gave $21.92 as the weighted average differential.

There are, however, 3,743 acres of land located on dirt roads, and 1,062 acres located on state roads, at distances farther from town than the classes used in obtaining the $21.92 differential, at distances ranging from 4.5 to 12.5 miles from town, which might have a widely different differential. However, when they are thrown together so as to give enough for a sample, the difference is only $26 per acre, $156 per acre for the land on state roads, and $130 for the land on dirt roads.

The $21.92 differential is further substantiated by separating farms on dirt and state roads and correlating each group with distances to market. The following forecasting equation results:

X= price per acre; Y= distance to market
State roads: X=187.29—7.04 Y
Dirt roads: X=161.47—5.05 Y

If this equation is applied to farms at various distances from market, e.g., 1.25 and 3.75 miles, the following prices result:
1.25 miles—state road, $178.49; dirt road, $155.16; difference, $23.33
3.75 miles—state roads, $160.89; dirt road, $142.53; difference, $18.36

Average difference $20.85

Again, after the values per acre of the farms on state roads were corrected by means of the differential $21.92, all the farms adjacent to Class II towns[12] were sorted out and classified on the basis of state and dirt roads. The 5,842 acres on dirt roads when thus corrected averaged $144.48 per acre, and the 2,433 acres on dirt roads $144.74 per acre. This indicates that the correction $21.92 must be very nearly right.

Again, when farms on state roads and dirt roads were correlated separately as to price per acre and distance from market, the coefficients of correlation were r=—.394 and r=—.240 respectively. After the values of farms on state roads were corrected by the $21.92 differential, and the values of all farms together correlated with distance from market, the coefficient was r= —.230, just .01 from the —.240 coefficient. Here again the $21.92 differential is substantiated. In the remaining calculations, therefore, the farms have all been converted to the dirt-roads basis according to this differential.

In this connection, it should be understood that the higher value of the land on state roads is due to the fact that such roads are, and always have been, main lines of travel, as well as to the quality of the road.

Differential for influence of cities and villages, markets, etc.—The cities and villages in the area were put in two classes on the basis of population and market facilities, Class I including Mankato, Lake Crystal, and Janesville, and Class II including all small towns of about 500 population.

The correction for the influence of Class I towns on land values was worked by cross-tabulation in the same manner as the differential for roads. The average value per acre of 3720 acres adjacent to Class I towns was $158.36; of 8290 acres to Class II towns, $143.98. This gives a difference of $14.37 per acre. Cross-classifications were made to test the validity of this $14.37 as a true constant difference. Table V shows that the remaining factors affecting land prices average nearly the same for Class II towns.

[12] Small towns of about 500 population.

TABLE V

AVERAGE VALUE OF FACTORS IN EACH CLASS OF TOWNS

Factors	Class I	Class II
Cost of buildings	$15.52	$12.71
Productivity index	99.7	95.0
Land-classification index	86.9	85.5
Distance to market, miles	3.96	3.45

Analyzed further, the following results appear:

A. For all farms located 2½ to 4½ miles from market, with productivity indexes between 89 and 100, the price of the land averaged for—

Class I towns	165.03	(1,299 acres)
Class II towns	$152.60	(903 acres)
Difference	$ 12.43	

B. For all farms where cost of buildings per acre ranged from $12 to $24 per acre, the prices of land averaged for—

a. Productivity indexes between 76 and 90 and —

Class I towns	$161.84	(507 acres)
Class II towns	151.48	(701 acres)
Difference	$ 10.36	

b. Productivity indexes between 90 and 104 and —

Class I towns	$155.64	(817 acres)
Class II towns	138.94	(1,486 acres)
Difference	$ 16.70	

c. Productivity indexes between 104 and 118 and —

Class I towns	$166.52	(542 acres)
Class II towns	154.52	(1,076 acres)
Difference	$ 12.00	

The average of the differences in *a*, *b*, and *c*, weighted on the basis of average, is $13.72.

C. For all farms on dirt roads, the price of the land averaged for —

Class I towns	$157.19	(2,915 acres)
Class II towns	144.48	(5,842 acres)
Difference	$ 12.71	

The average of the differences in A, B, and C, weighted according to acreage, is $12.82. This was used to convert all Class I towns to a Class II basis.

At this stage in the analysis, all farms have been reduced to the following basis: Sold in 1919; on dirt road; adjacent to Class II towns. The four remaining factors influencing land prices, namely, cost of buildings per acre, type of land, productivity of soil, and distance to market, will be handled by partial correlation methods.

Calculation of 1919 depreciated cost of buildings.—The dimensions and type of structure of each building were obtained in the field. From the dimensions, the cubic-foot content of each farm structure was calculated. This was then multiplied by a certain cost per cubic foot depending on the type and kind of structure. This cost was then depreciated down to the year 1919. The depreciation rate used was

based on the condition of repair of the building and its age. Cost of buildings was reduced to an acre basis before being used in the correlation. The following is a sample of the calculations for one farm:

TABLE VI

SAMPLE CALCULATIONS OF BUILDING COST

Building	Cubic feet	Cost per cubic foot	Cost	Depreciation to 1919	Depreciated cost 1919
Dwelling	11,520	$.14	$1,612.80	38%	$999.94
Barn	16,456	.05	822.80	51%	403.17
Hen house	3,500	.05	175.00	80%	35.00
Machine shed	4,000	.03½	140.00	80%	28.00
Milk house	1,260	.05	63.00	51%	30.87
Granary	4,480	.05	224.00	28%	161.28
Corn crib	7,500	.03½	262.50	80%	52.50
Shed	2,160	.05	108.00	28%	77.76
Total 1919 depreciated cost					$1,788.52

The cubic-foot costs used are given in Table VII. Silos were each considered separately because of varying types of construction.[13] For depreciation tables used, see Appendix B.

TABLE VII

BUILDING COST PER CUBIC FOOT

Type of building	Cost per cubic† foot in 1919
	Cents
Dwellings, frame, small box house, no cornice	9½
Dwellings, frame, shingle roof, small cornice, plain	12 to 14
Dwellings, brick, same class	16½ to 19
Dwellings, frame, shingle roof, good cornice, sash weights, good house	16½ to 19
Dwellings, brick, same class, good house	21½ to 24
Barns, frame, shingle roof, not painted. plain finish	3½ to 6
Barns, frame, shingle roof, painted, good foundation	6 to 7
Single corn crib*	4
Double corn crib*	3½
Machine shed*	3¼

* Calculated by the writer.

† Wm. Arthur. "New Building Estimator," p. 311. Prices for 1902 were raised to the 1919 level by using the U. S. Bureau of Labor indices of building material prices, and wages of carpenters, bricklayers, painters and common laborers. Bulletins Nos. 269 and 77, U. S. Bureau of Labor.

Land-classification index.—The percentage of each type of land could have been entered directly in the multiple correlation equation, but not without increasing the required calculations many fold. Hence, all the grades were reduced to a common denominator and expressed in one figure, which was called the land classification index. This was calculated by weighting the percentage of each class of land by a figure

[13] Ibid. Silo cost data—p. 535-555.

representing its approximated relative value significance. The weights used were:[14]

		Weights
Grade 1.	Woods—not potentially tillable[15]	1/5
Grade 2.	Woods—potentially tillable	1/2
Grade 3.	Wild hay land	3/4
Grade 4.	Tillable	1

Following is an illustration of how this method was applied to a given farm. The 10 per cent of Grade 1 land was multiplied by the weight 1/5, etc. The index for this farm is 82.

Grade	Per cent	Weights	Index
Grade 1	10	1/5	2
Grade 2	10	1/2	5
Grade 3	20	3/4	15
Grade 4	60	1	60
Land Classification Index			82

Productivity-of-soil index.—The productivity index is a relative figured on the basis of the average yields of the principal crops grown in Blue Earth County. The crops were considered of equal weight. The index for each farm is the average ratio of the three-to-five year average crop yield of the farm to the average crop yield of the county. Ordinarily it would be well to weight the different crops according to their importance, but in this case the crops were of about the same importance.

TABLE VIII

ILLUSTRATION OF CALCULATION OF PRODUCTIVITY INDEX FOR ONE FARM

Crops grown	Average yield per acre	County average yield per acre	Per cent of county average yield
Corn, bu	65	48.23	134.7
Oats, bu	55	41.26	133.2
Spring wheat, bu	18	12.53	143.5
Clover and timothy, tons	2	2.18	91.5
Productivity-of-soil index			125.80

[14] The weights were approximations resulting from judgments based on the observation of sales of the various grades, and on data in Minnesota Bulletin 145, "The Cost of Producing Minnesota Farm Products"; Minnesota Special Bulletin No. 19. "Cost of Milk Production"; Minnesota 1920 Census; and the Crop Reporter, Dec., 1919. The weight 3/4 placed on wild hay land may seem a little large; but this was usually good low land which could be tiled. It was not tiled, however, because the farmers found that especially in dry seasons the wild hay crop would compensate for the short crop of tame hay.

[15] Includes other not potentially tillable land which can be pastured.

Distance to market.—The distance to market was obtained by asking the farmer the question, How far is it to the town where you market most of your products?

The correlation.—The following five factors were then considered in multiple correlation:

X_1 = Value per acre corrected as previously explained.
X_2 = 1919 depreciated cost of buildings per acre.
X_3 = Land classification index.
X_4 = Productivity of soil index.
X_5 = Distance to market.

The forecasting equation which resulted is:

$$X_1 = +57.785 + (1.067 \cdot X_2) + (.7279 \cdot X_3) + .1658 \cdot X_4 - 3.422 \cdot X_5$$

It is interesting to note some of the relationships brought out by the equation. An increase in a dollar's worth of buildings per acre increases the land value $1.07 per acre. This is a very significant result, as it substantiates the general practice of adding the depreciated cost of buildings to the land value in order to secure the value of the farm real estate. It also indicates the relative accuracy of the method used in this investigation for calculating the depreciated building costs. An increase of one point in the land classification index results in a rise in the value per acre of 73 cents. In this area the productivity-of-soil index was the least significant factor studied. An increase of one point in this index results in a 17 cent increase in the value per acre. This index merely indicates soil productivity differences, most of the land variation being indicated by the land-classification index. The most interesting and yet the most difficult relationship to study was that of distance to market and value per acre. Coupled with this relationship is the relative significance of the type of road and class of town. On a farm which is on a dirt road and adjoining a Class II town, each mile from town decreases the land value per acre $3.42.

The extreme range in value of buildings per acre is from nothing, on 40 pieces of land, to $83; the ordinary range is from $5 to $35 per acre, and the modal group is from $10 to $20.

The land-classification index ranges from 25 to 100 (on 25 farms), and all but 31 farms have an index of 75 or more. A farm with an index of 75, other things being the same, will be worth $18.20 less per acre than one with an index of 100, and one with an index of 50 will be worth $36.39 less. The extreme range in productivity indices is from 60 to 140, and the ordinary range from 80 to 120. A farm with a productivity index of 80, other things being the same, is worth $6.63 less per acre than a farm with an index of 120.

Half of the farms were between 2 and 5 miles from market; 20 more were between 5 and 7 miles, and 22 more between 7 and 9 miles; 19 were less than 2 miles from market. Other things being the same,

the farm farthest from market, 11½ miles, is worth $35.92 less per acre than the farm a mile from market.

Following are two illustrations of the use of the forecasting equation:

No. 1. Farm sold in 1918 for $150 per acre—state road, Class I town:

X_2 = 1919 depreciated cost of buildings per acre..... $36.24
X_3 = Land-classification index..... 87
X_4 = Soil-productivity index..... 96.6
X_5 = Distance to market..... 9 miles

$X_1 = 57.785 + 1.067\ X_2 + .7279\ X_3 + .1658\ X_4 - 3.4219\ X_5$
$X_1 = 57.785 + 38.668 + 63.327 + 16.016 - 30.797$
$X_1 = 144.999$
+21.92 state road correction
+12.82 "Class I" town correction

$179.739
×.8584—1918 land-value index

$154.28 =estimate. $150=actual sale price.

No. 2. Farm sold in 1919 for $135 per acre—dirt road, Class II town:

X_2 = 1919 depreciated cost of buildings per acre..... $12.47
X_3 = Land classification index..... 75.62
X_4 = Soil productivity index..... 103.7
X_5 = Distance to market..... 3.5 miles

$X_1 = +57.785 + 1.067\ X_2 + .7279\ X_3 + .1658\ X_4 - 3.4219\ X_5$
$X_1 = +57.785 + 13.305 + 55.043 + 17.193 - 11.976$
$X_1 = 131.35$ = estimate. $135 = actual sale price.

The multiple correlation between one variable, such as land sale prices, and several other variables, such as the four value factors, is expressed by R, which in this case equals .81. If these four factors alone accounted for all the variations in sale prices, R would be 1.00. Statisticians consider an analysis giving a result as high as .81 as reasonably successful.

Appraisal by means of this equation involves a probable or average error of 9.55 per cent of the average sale price, or $15 per acre. This means substantially that one half of the appraisals would be less than 9.55 per cent in error, and that the other half would have more error than this.

The forecasting equation was applied to each farm in the survey and the results checked against the sale prices. A frequency table of the differences shows that 24 farms are within $5 of the sale price, and 22 more within $10 of the sale price. On the other hand, there are 13 farms more than $30 too low, and 21 farms more than $30 too

high. When these farms are examined, certain deficiencies in the present survey become apparent.

First, it is evident that the method of reducing the sale price to the 1919 basis by indices based on the average of the year's sales, has introduced considerable error, especially in farms sold in 1919 when the land boom was getting under way. This is obviously the largest source of error. This error can be eliminated largely in future surveys. (See page 14.)

Second, it is evident that the land classification index was crude and based on insufficient evidence. The proper method is to include the proportions of the different classes of land as variables in the multiple correlation analysis. Each class of land will then be represented by a member in the forecasting equation. This error showed especially in pieces of land with no buildings upon them, which sometimes were nothing but meadows or timber lots.

Third, special circumstances affecting many of the farms were not included in the analysis. Among these are location close enough to a city to give the land prospective value as sites for city residences. Another is location on a lake front. Future surveys may omit these farms, or else include enough of them to permit the special circumstances involved to be included in the equation.

Fourth, the yield data did not cover a long enough period. A systematic use of this method would give data over a constantly increasing number of years. Furthermore, the yield of crops is dependent in part upon the ability of the farmer, and the part of the yield thus determined is only to some extent reflected in land values. Yield of crops is, therefore, not a satisfactory basis for a productivity-of-soil index. However, it is probably the best basis at present available.[16]

The equation, however, gives relatively small weight to productivity in so far as it is not included in land classification.

It is likely that the productivity of the land in producing pasturage for dairy and beef cattle and sheep should figure in the index wherever these are important farm enterprises. Also, as already pointed out, the various crops should be weighted according to their importance on any farm.

After all these improvements have been introduced into the method, there will still be a difference between the actual sale price of any farm and that which the equation would indicate. The primary reason for this is the disorganization of the land market already discussed. The same quality of land does not sell for the same price at the same time. Many sales are made at prices too high or too low. In this respect, the values indicated by the equation will be more accurate

[16] If the methods outlined in this bulletin are ever used in assessing land, there will, of course, be serious objections to using yields as a factor in values.

than the actual sale prices. The other error remaining will be due either to errors in the measures used for productivity, land classification, value of buildings, class of town or type of road, or to the presence of other factors affecting land values on certain of the farms.

It is not unreasonable to believe, however, that the probable error can be reduced under 5 per cent, perhaps under 3 per cent, in areas when the land is as uniform as in Blue Earth County. A probable error of 3 per cent would mean that half the appraisals were within less than $4.70 per acre of the sale price. If this could be accomplished, the appraised value would undoubtedly be a safer measure of value than actual sale price on a majority of farms. In other words, it would mean that the errors in this method were less than the errors caused by the disorganization of the land market.

In areas where land is less uniform in type and quality, it is not likely that as accurate an equation can be obtained.

APPLICATIONS

The method of appraisal here outlined can be of great practical value for many purposes, chief of which are the following: (1) as a basis for mortgage loans; (2) as a basis for assessment and taxation; (3) as a basis for buying and selling; (4) for inventorying a farm business or an estate; (5) as a basis for estimating rent on different farms and different classes of land where rents are needed for cost accounting; (6) as a basis for determining benefits and damages from drainage ditches, roads, and other local improvements; (7) as a basis of settlement of court disputes involving questions of land values; (8) for making valuation of farm land used in railway right-of-ways and the like.

The Federal Land Banks, the joint stock land banks, other banks, mortgage companies, insurance companies, and others who loan money on farm land are in need of a scientific measure of farm land value such as is here presented. Land credit can not be put on an equitable basis unless farm values are appraised accurately. The lack of this value information is the principal reason for our present "conservative" policy, for with underestimated valuations and with his security thus understated, the farmer is not able to get all the credit he desires. This is not only of interest to farmers, but also to the investors. The investor wants to be certain that the values placed on the mortgaged land are their true values. If the investing public was convinced that such valuations represented true market values, it would no doubt accept a lower net yield on the investment in lieu of the decreased risk due to accurate appraisal. Accurate appraisal would thus bring about lower interest rates to farmers on long-time credit.

It would be comparatively easy for the Federal Farm Loan system to use the methods here outlined once they were perfected. First of all, the territory of the United States would need to be blocked out into large areas where conditions are similar. In each of these, a survey would need to be made including preferably 1000 farms located in several representative counties in various parts of the area. The factors selected as influencing land values would be somewhat different for the different areas. The forecasting equation obtained could be applied to all the farms in the area except a small number with pronounced characters not represented in the equation. The same equation could be used by insurance companies, farm mortgage companies, and even local banks. Of course the smaller the area included in the survey, the more uniform conditions are likely to be and the more dependable the equation.

The assessed valuations of the 160 farms covered in the survey have the amazing probable error of 26.7 per cent of the average sale value, or $33 per acre, compared with the probable error of 9.55 per cent of the average sale value, or $15 per acre, in the results obtained in this survey. A probable error of 26.7 per cent means substantially that half the assessed valuations are more than $33 per acre above or below the sales price. If nothing more had been done than to apply the average sales price, $157.23 per acre, uniformly to all farms, the probable error would have been only 16.4 per cent, or $25.76 per acre.

This method of analysis of assessed values sets up sales prices as the standard, and all departure from this is considered as an error. From the standpoint of the state as a whole, and on the assumption that all forms of property, city real estate, railroads, mines, etc., can be and are assessed at full current values, this method of analysis is correct. Also from the point of view of distributing state taxes equitably between the various counties of the state, either all farms should be assessed at current market value, or else all on some other uniform basis that gives equal departure from it in all counties. It is hard to conceive of any workable standard other than current market values.

However, from the point of view of treating all farms in a county alike, the foregoing analysis does not fit. Of the error of $33 per acre, $11 was due to the fact that land is in general assessed too low. If the level of assessed value is set up as the standard, and departures from this are considered as error, then the probable error is $21 per acre, or 17.3 per cent of the average sale value at the time of assessment. The percentage figure is the proper basis of comparing. This 17.3 per cent is to be compared with 16.4 per cent probable error if the average sales price had been applied uniformly to all the farms, or 9.55 per cent if the method of appraisal outlined in this bulletin had been used, and

perhaps under 3 per cent if this method were further developed and the equation expanded to include more variables.

The method of appraisal here outlined could be generally used for purposes of assessment. Ordinarily the county would be the unit, altho it might be advisable to section the county if it had two or more distinct types of soil, topography, and agriculture. To start with, the first year under the new method the assessors in their regular visits would fill out a schedule much like the one in Appendix A. In succeeding years, all the additional information which they would get would be yields during each preceding year, and dimensions and descriptions of new buildings and other improvements. From the assessor's reports, the farms sold within recent years would be selected, and the data on the assessor's schedules for these farms used in a correlation analysis with the recorded sales prices now regularly obtained. This would give an equation which could be applied to all farms in the county. The actual assessing of land values could be done in the office of the State Tax Commission. Once the equation was obtained it would be used year after year simply by correcting it to fit the changes in land values indicated by the sales records. A recalculation of the equation after several years would, however, be desirable so as to make use of the gradually accumulating yield data.

There would be some extra expense involved in getting the new system under way. The assessor's work would be heavier the first year. The calculating of the equation the first year would take two or three persons perhaps a month. But once the system was under way, it is doubtful whether it would entail any greater expense. After the first year, the work of the local assessors would be simplified and reduced. It is quite likely that similar methods could be used in valuing livestock and equipment. In the end, therefore, there might be very little for the assessor to do. He would become a sort of enumerator, all valuations being made by the Tax Commission. Assessments could then be taken entirely out of politics. Farmers would know that their farms were being assessed on a strictly objective. scientific basis with no possible chance for favoritism or prejudice.

Using this method, the State Tax Commission could at one stroke attain the "full and true" value assessment which is so difficult with local assessors making the valuations.

What is even more important, once the significance of the various factors influencing land values was determined, taxes could be levied more equitably and intelligently. For example, road expenses could be distributed according to road benefit. Location value could be taxed at a different rate from buildings or productivity value.

Closely related to the foregoing, is the use of the method to determine benefits and damages from drainage ditches, roads, and other local improvements. Equations already developed for general taxation purposes would be sufficient in some cases; in others, special surveys would need to be made.

There are many farm real estate agencies with enough business to warrant their using these methods. But the only use made of them need not be in buying and selling land. The real estate men in a county can with advantage organize a county real estate board and equip it to render this appraisal service to its members and to the public in general. City real estate boards have found that such a service helps their members to make sales because it reassures buyers. This county board would obtain all needed information concerning each farm as it was sold, and on the basis of this develop an equation. If it wished to begin appraising at once, however, it would need to make a survey of past sales.

The general use of this system by real estate men and buyers and sellers of land would have the same effect on the land market that setting up market grades has had on the grain and livestock markets. It would, therefore, be of great public benefit. It might even be possible to quote prices on various grades and types of land.

In all surveys for the purpose of studying farm organization, the placing of values on the farms has been one of the difficult problems. An analysis of the valuations made in two surveys by the Office of Farm Management of the United States Department of Agriculture has shown a high probable error. This error, however, has not been of much significance so far as the conventional type of farm business analysis is concerned. But there are analyses that should be made in which this error would be a serious handicap.

Farm cost-accounting studies frequently need valuations of different types of land in one farm. This method could be made to supply these valuations.

With so many agencies having need of the results of such analysis and appraisals, it would seem foolish for each to undertake the task independently. Some public agency, such as the Tax Commission, could do the work for all. All that the land banks or insurance companies, or a real estate board would then need would be an organization to apply the results.

APPENDIX A

SCHEDULE

LAND:		
Acres in purchase.....	_____	No. of farm_____
Woods not pastured.....	_____	Name of owner_____
Potentially tillable_____	XXXXX	Date of purchase_____
Woods pastured.....	_____	Distance to market_____
Potentially tillable_____	XXXXX	Name of market_____
Other non-tillable pasture.....	_____	Type of road_____
Rough_____ Wet_____ Stony_____	XXXXX	Rods frontage_____
Tillable pasture.....	_____	Topography _____
Wild hay land ( )	_____	Soil types_____
Other tillable land.....	_____	Remarks _____
Waste land ( )	_____	
.....	_____	
	_____	

BUILDINGS:	Dimensions	When built	Construction cost	Condition	Type of construction	Remarks
Dwelling						
Barn						
Hog barn....						
Hen house...						
.....						
.....						
.....						
Granary						
Corn crib....						
.....						

CROPS: Yields

Year	Corn	Silage	Oats	Barley	S. Wheat	W. Wheat	Rye	Potatoes	Wild hay	Tame hay
1920										
1919										
1918										
1917										
1916										

INSTRUCTIONS FOR USE OF THE SCHEDULE

1. Number each schedule with the number which appears on the county map and sales-transfer card.

2. Check the "acres in purchase" against the seven classes of land listed, namely, "woods not pastured," "woods pastured," "other non-tillable pasture," "tillable pasture," "wild hay land," "other tillable land," and "waste land."

3. The classification is so arranged that tillable land can be separated from all non-tillable land; also pasture land from crop land and woods. These totals can be worked out later.

4. Under "non-tillable pasture" indicate by a check mark whether it is non-tillable because of roughness, wetness, or stones. If there are two or more reasons, indicate the number of acres accounted for by each.

5. "Wild hay land" will include meadow too wet to be plowed, and, in some cases, land too rough to be plowed. Indicate in the parenthesis following the reason the land is kept in wild hay.

6. Indicate in the parenthesis after "waste land" the nature of the waste land. The part of the waste land which is caused by roads can be estimated from the "rods frontage" listed in the next column.

7. Fill in the name of owner and date of purchase before visiting the farm.

8. In a few cases you will find that the farm you visit has been sold since your last record of transfer. If you can get the farmer to tell you the amount of the transfer, it will be worth while for you to take the record as of the latest date.

9. Under "rods frontage" count up the number of rods of road taken out of the farm. If the road passes through the farm, the rods will need to be doubled, because in this case four square rods will be taken out for each rod of road in place of two square rods.

10. Under "soil types" indicate the soil type as described in the soil map of Blue Earth County. If a farm has more than one soil type, indicate the relative proportions of each. This will require that the farm be located rather definitely on the soil map. This can probably be done by matching the soil map against the plat book map. This work can be done mostly after you get home.

11. Under "remarks" mention any unusual circumstances, such as stony land, floods, poor drainage, run-down soil, land improvements, etc.

12. "Construction cost." Obtain the cost of original construction of a building whenever the farmer happens to know what it is.

13. "Condition." In general, describe the condition of the building as "very good," "good," "fair," "poor," or "very poor." Abbreviations may be used for these terms.

14. Under "remarks" enter any special circumstances connected with the construction of any of these buildings, such as sanitary barn equipment, etc.

15. Express the "yields" of the various crops in their usual units, i. e., corn in bushels per acre, silage in tons per acre, etc. Get data as to yields from any available source that you can. Very frequently the farmer who is on the place will not know very much about the yields made by his predecessor. If necessary, get the desired information from the neighbors, threshermen, etc.

16. The classification "tame hay" may mean red clover, alfalfa, timothy, or timothy and clover mixed. It might be well to indicate which is referred to, by some form of abbreviation.

APPENDIX B

TABLE I

DEPRECIATION TABLES FOR FRAME DWELLINGS*

Years	Percentage depreciation according to condition		
	Good	Fair	Bad
	Per cent	Per cent	Per cent
1	3	4	10
2	6	7	17
3	8	10	23
4	10	12	27
5	13	15	31
6	15	17	34
7	17	19	37
8	18	21	40
9	20	23	42
10	22	25	45
11	23	26	47
12	25	28	49
13	26	30	51
14	28	31	53
15	29	32	55
16	30	34	57
17	31	35	58
18	32	36	60
19	33	37	61
20	34	38	63
21	34	39	65
22	35	40	66
23	36	41	68
24	37	42	69
25	37	43	71
26	38	44	72
27	39	45	74
28	39	46	75
29	40	47	79
30	41	48	80
31	41	48	80
32	42	49	82
33	42	50	83
34	43	51	85
35	43	52	86
36	44	53	88
37	45	53	90
38	45	54	91
39	46	55	93
40	46	56	95
41	47	57	..
42	47	59	..
43	48	59	..
44	48	59	..
45	49	60	..
46	50	61	..
47	50	61	..
48	51	63	..
49	51	64	..
50	52	64	..

* Used in Cleveland Valuation, published in "New Building Estimator" by Wm. Arthur.

TABLE II

DEPRECIATION TABLE FOR BRICK DWELLINGS

Years	Depreciation
Per cent	Per cent
1	5
2	7
3	9
4	11
5	13
10	18
15	23
20	28
25	33
30	39
35	45
40	50
50	60
60	70
70	80

TABLE III

DEPRECIATION TABLE FOR BARNS, GRANARIES, AND OTHER FARM BUILDINGS*

Years	Depreciation rate according to condition		
	Good	Fair	Bad
	Per cent	Per cent	Per cent
1	10	12	14
2	12	15	17
3	14	18	20
4	16	21	23
5	18	23	26
6	20	26	29
7	22	29	32
8	24	32	35
9	26	35	38
10	28	38	41
11	30	41	44
12	32	43	47
13	35	47	53
14	38	51	59
15	41	55	65
16	43	59	71
17	46	63	77
18	49	67	83
19	52	71	..
20	55	75	..
21	58	79	..
22	61	81	..
23	64	..	..
24	67	..	..
25	70	..	..
26	73	..	..
27	76	..	..
28	79	..	..
29	82	..	..
30	..	..	..

* The Bernard Depreciation Table, "How to Assess Property in Cities and Rural Towns." In report of the Wisconsin Tax Commission, 1914, p. 32. H. V. Cowles and J. H. Leenhouts.